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ADVENTURES OF A WATERMOL

A ROMANCE OF THE AIR, THE EARTH AND THE SEA. II

BY PROFESSOR H. L. FAIRCHILD
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SYNOPSIS OF THE PRECEDING CHAPTERS: In the January number of the MONTHLY the water molecule tells of its birth, in an ancient volcano perhaps one hundred million years ago, and relates some of its romantic experiences, in the atmosphere, cloud, ocean, glacier and iceberg.

IN THE OCEAN ABYSS

THE water in which I was liberated from the iceberg was fearfully cold and heavy and the polar current carried me slowly down to great depth in the abyss of the ocean. It was terribly cold and the pressure was immense, even more than in the glacier. I went down to near the bottom of the deep ocean, down 20,000 feet, I should think. Though the temperature was below that for freezing at the surface, the pressure and the salt substances which we watermols held in solution prevented our turning into ice.

To this great depth the sunlight never reached. At lesser depths there was a faint light or phosphorescence produced by curious fish and other animals. It was a weary, weary time; perhaps not worse than in the glacier, but different. In the glacier, as I have said, it was a sort of frozen silence. Here it was a liquid solidity. In the glacier we watermols were kept in stillness and idleness, while here in the ocean deeps we yet had cold and darkness and crushing pressure and besides we had to keep in captive subjection the many substances which are found in sea water.

Very slowly the cold water in which I lay drifted toward the equator. But it took long ages of time before we reached the equatorial region. In the warm tropics the watermols at the surface of the sea are stolen away so rapidly by the air that the deeper water very slowly rises to fill the space. Slowly, dreadfully slowly, I was lifted upward. Maybe it was a million years until once more I was at the warm surface of the ocean.

IN TROPIC SEAS

Floating about in the warm water of the tropic sea, in the bright sunshine and with many curious animals swimming about, was much nicer than being in the frozen heart of a glacier or in the silent pressure of ocean abyss. And curious adventures befell me here. Once a frond of seaweed seized me and built me into its pulpy mass, and as a part of the plant I was floated about the sea during all the life of the fucoid, which must have been more than a century. Once a big sea-jelly, or so-called jellyfish, gulped me down into his baglike stomach and sent me in the current through his many tubes or canals, and then he added me to his soft, watery flesh. But one day the angry waves in a big storm dashed my seajelly on the rocks and he was beaten to death, and in the decay of his substance I was liberated. Many of the different kinds of animals which live in the sea have, at one time or another, made food of me and have carried me into their flesh or the cavities of their bodies. I may mention the coral polyp, the sea urchin, the oyster and the devilfish. But the animals all die, while I live on. My adventures with some of the larger and higher animals will be told later.

When free in the ocean my fellow watermols and I were always busy, holding in captivity or solution the molecules of many gases and solids. In later times, more than once I have been in the water current that was sucked through the gills of a fish or other animal when molecules of oxygen were taken away and carbon-dioxide molecules given back in exchange.

I have been in all the great currents of the ocean, such as the Gulf Stream, and have felt the daily tides for many millions of years. I have been in the spray on the crest of storm waves, and in the white foam of breakers on the shores of coral islands.

During this episode of which I am telling, the tides and currents of the tropic seas drifted me about for a long time, until one hot day when I was lazily resting at the very surface of the water I was grasped and pulled away from my fellow watermols by the warm air, and again was floated far away in the atmosphere, a captive of the nitrogen molecules.

IN A SUBTERRANEAN RIVER

Sometime, it was certain, I should be again dropped on the sea or land. And again I was built into a raindrop. After helping to carry the electricity of a terrible lightning storm I fell on the ground in some faraway land. The ground absorbed the water and I went down and down into the earth. Finally I fell in a little stream which came out as a spring on a sunny hillside. Flowing down the slope and then a long way down the valley the little stream joined a small river. Many miles further the river passed beneath the surface of the ground and plunged into a subterranean channel in limestone rock. Finally it carried me into a lake in a great cave in the limestone. For years I was there in darkness. This was a new experience.

Like the depth of the glacier, and the ocean, it was perfectly dark. But it did not have the great pressure and the extreme cold. And there were no waves and no strong currents because there were no winds. It was a tiresome place. I only had to help hold some calcium carbonate in solution.

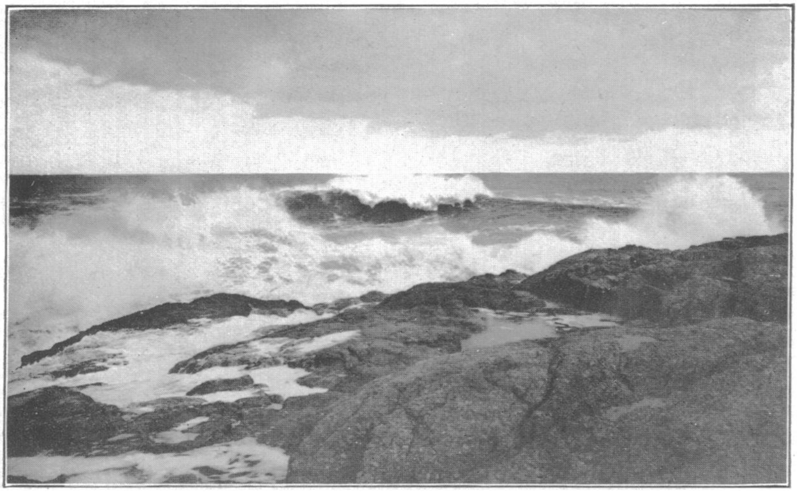
All the underground river channel and the cave had been the work of other watermols, my predecessors, for thousands of years. But not only had they dissolved and removed the rock to make the cave, but to show that they could build as well as tear down they had formed beautiful objects in the cave as samples of their construction. Long masses of translucent limestone, of white, yellow and pink color, and shaped like icicles, were left hanging from the roof of the cave-stalactites. In some parts of the cave, which the lake did not cover, conical, needle-shaped and columnar masses of the same elegant material rose from the floor-stalagmites. The beautiful material called "Mexican Onyx" is of similar origin. Some other examples of our constructional work are the lime deposits made by hot water in the open air, as at Mammoth Hot Springs.

Very slowly the drift carried me through the lake and finally out of the subterranean channel into the open air and light.

In a Coal Plant

The river in which I floated out of the ancient cave carried me into some lake, and after a time I was again taken up by the air. And again I was in a raindrop and fell upon the ground, and sank into the earth. I wondered what new experience was coming; and the event was unexpected. Some of my fellows were drawn back into the air, which was always seeking to keep us. But I sank deeper in the earth. I was drawn along between the mineral grains which composed the soil, by the attraction called tension or capillary attraction. Then I lay close against the tiny rootlet of a tree. The rootlet took violent hold of me and drew me right through its wall and into its interior. In a watery fluid I was then carried into a larger root; then into the trunk of the tree: then up the tubes or ducts of the wood; out into a branch; into a branchlet, and at last into a leaf. All this time I was compelled, with multitudes of other watermols, to carry along other substances which the tree required for food. These were mineral compounds containing nitrogen, phosphorus, sulphur, potassium, etc. We watermols were the food-bearers for the tree. Our ride in the sap of the tree was not free; we had to work our passage.

In the leaf we assisted the tree in preparing and digesting its food. I was helping in the life and growth of one of the strange trees of the Coal Period, called Lepidodendron. And actually I was helping to



Courtesy of Eastman Kodak Co.

FIG. 12. WATERMOLS ATTACKING THE CONTINENT.

produce coal, in China. By the green substance in the leaf, known as chlorophyll, the tree was able to draw a supply of power from the sun. Carbon-dioxide was taken in from the air and broken up. The carbon was kept to unite with us watermols and the oxygen was given back

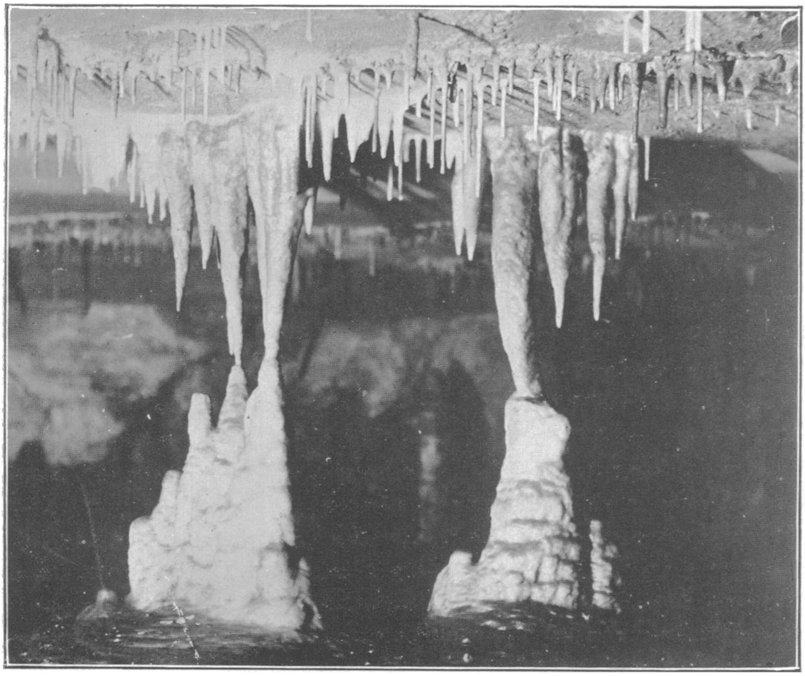


FIG. 13. WATERMOL ARCHITECTURE.

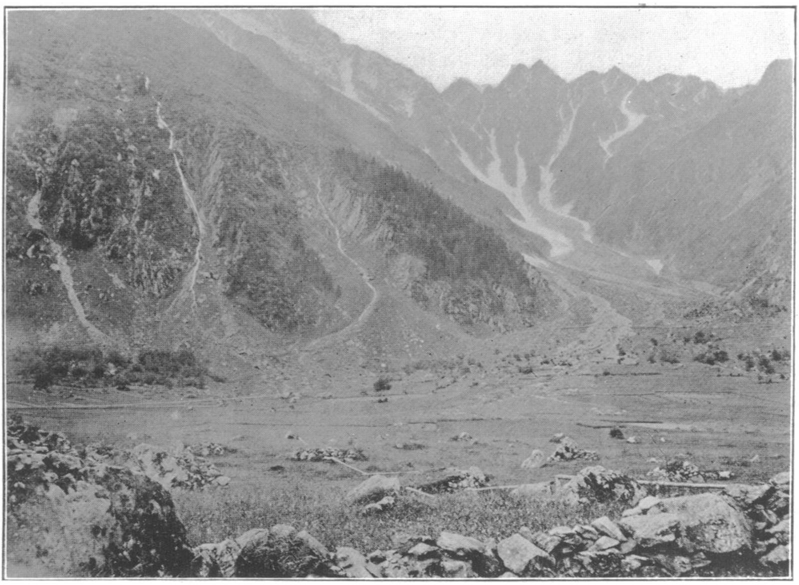
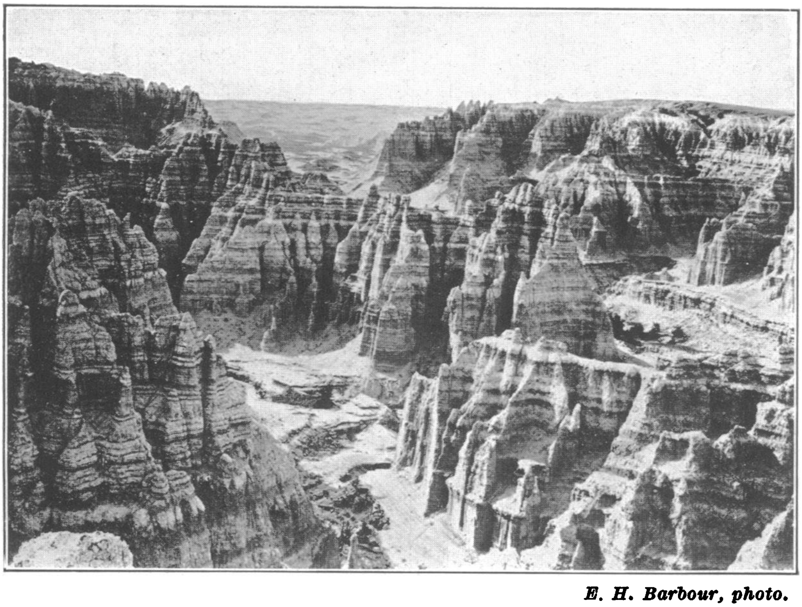


FIG. 14. WATERMOLS TEARING DOWN THE MOUNTAINS.

to the air. The substance of the tree was built up from us watermols and the carbon of the air. Many of my fellows were used as food for the tree and were built into its wood. I have been told that this par-



E. H. Barbour, photo.

FIG. 15. WHERE WATERMOLS UNDO THEIR OWN WORK.

ticular tree in its old age fell into the marsh in which it grew, and became part of the peat deposit which is now a coal bed one thousand feet in the earth. Some of the watermols which worked with me in the sap and leaf were built into the wood of that tree and are now down in that ancient coal deposit. More than once have I just escaped such fate. But after being employed in various kinds of chemical work, and in carrying sugar to the tissues of the tree, I was fortunate in escaping. One bright day when I was near the surface of the leaf I passed out, by evaporation or transpiration, into the freedom of the air and sunlight.

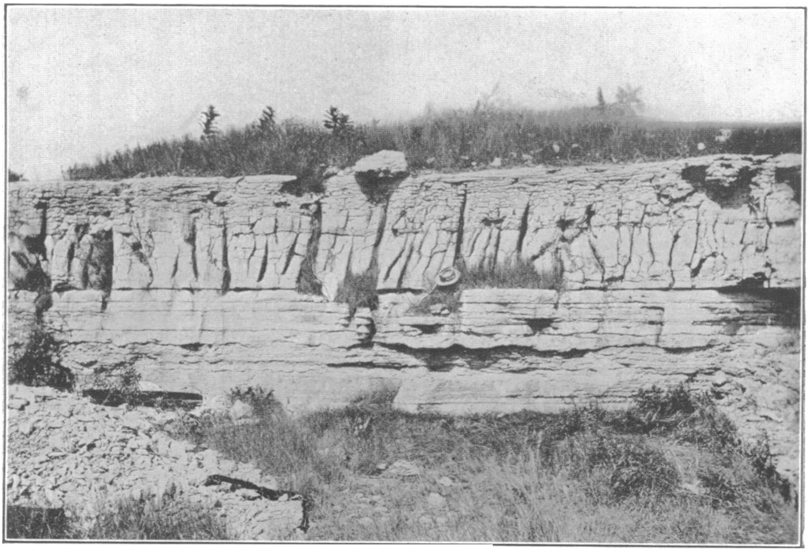


FIG. 16. LIMESTONE BEDS DEPOSITED BY WATERMOLS.

ALMOST A PLANET

Again I was up in the sky, with more freedom of vibration, the happiest of all the many conditions I have found. I knew that sooner or later I would be carried down to earth again by snow or rain. But this time I was driven by collisions with other molecules on and up and up until I was far from earth and out in the very rare atmosphere. Here all the molecules, nitrogen, oxygen, hydrogen, and we water molecules, were farther apart, with less interference, fewer collisions and longer free paths of vibration. The elastic rebound from some collisions gave certain molecules, especially hydrogen, such velocity in outward paths (critical or parabolic velocity) that they passed beyond the earth's control, the earth's effective gravitational pull, and were lost to the earth; though not lost to the solar system. At times a lucky (or unlucky) rebound might have thrown me so far away that the earth-pull could not entirely check my flight and draw me back. Then

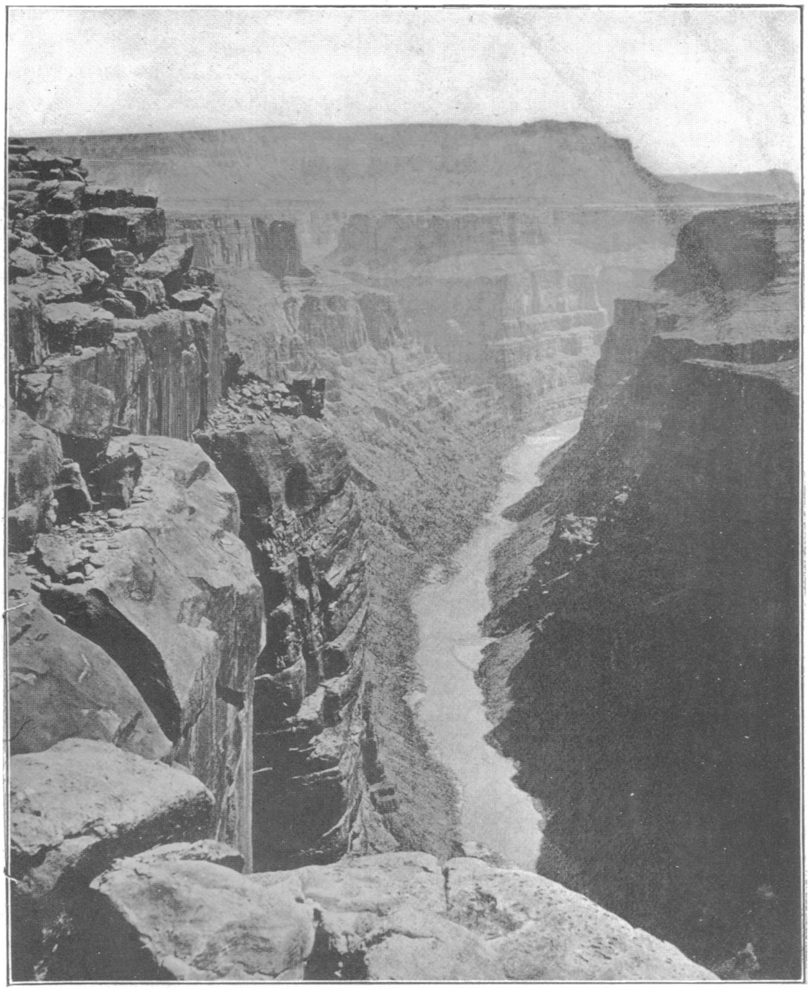


FIG. 17. A LITTLE BIT OF WATERMOL WORK.

I would have been a really free molecule in interplanetary space and would have had my own independent orbit around the sun. Ah! then I would have been a planet of the solar system, a single molecule, a little brother of the earth and Jupiter. Perhaps it were more correct to say, a little child of the earth and nephew to Jupiter. Multitudes of watermols and molecules of lighter gases, as hydrogen and helium, have left the earth and are either moving in space about the sun or have been captured by the planets or the asteroids. As the sun's effective attraction reaches far beyond the orbit of the most distant planet probably few molecules could ever escape into stellar space. It is believed that the present ocean and hydrosphere does not represent all the water which the earth has exuded or perspired, especially in its early or youthful stages, when it was smaller and its attractive power was less. But to counterbalance this loss it is probable that the globe has acquired many watermols and other molecules which had been wanderers in space, having been expelled from the sun, or perhaps were lost children of the other planets or emigrants from the moon.

That would have been a far leap for me, into the deep abyss of space. I was too timid, and clung to the atmosphere. When I bounded into space I took an elliptical instead of parabolic curve and so returned. I resisted the temptation of becoming a tiny planet all by myself: a little rival of the planets and asteroids. But, after all, it would not have been a very vainglorious existence, because no astronomer would ever have discovered me. I should have remained unknown, a lost watermol wandering in the infinite spaces, unmissed and useless. And yet! according to the law of gravitation the great sun and even the distant star-suns should have felt the pull of my attraction. But such a tiny pull!

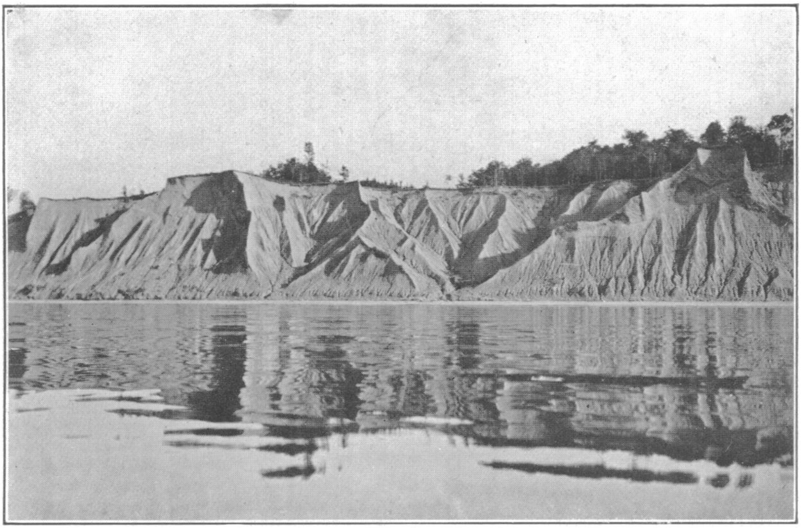


FIG. 18. WATERMOLS REMOVING THE LAND.

However, some day, if I survive long enough all the dangers that face a watermol and have grown tired of the earth, I may venture the leap to outer space and abandon this old sphere and let it take of itself without my help.

IN THE SOUTHERN HEMISPHERE

So I remained in the captivity of the air, and the swift currents of the outer atmosphere carried me downward and far southward, and I found that I was in the southern hemisphere.

It would be tedious to relate many of my adventures there, as it would repeat some already told. The time was early Mesozoic, or the Period of Reptiles, and I met some of the queer plants and queerer animals of the ancient reptilian time. The lakes and rivers and clouds and storms, and halos, coronas and rainbows that I helped to form were not unlike those of all lands in any time. But the life of different lands during the several geologic periods was very changeable, and this gave variety to my existence.

I was long immersed in the waters of the South Pacific ocean, which at that time was not so large as to-day, because the dry land in the southern hemisphere was more extensive and the southern continents were then connected. I fell in with some of the huge swimming reptiles. One was fish-like in shape, with paddles, and perhaps thirty feet long. He had an enormous mouth for seizing fish and a multitude of sharp conical teeth. This was the Ichthyosaurus, but I doubt if he knew his name. Another one, the Plesiosaurus, had a snake-like neck and head on a short body. Among the big mollusks were the Ammonites, related to the modern pearly nautilus. Once on the land I saw some of the huge Amphibians of that and the preceding period. One was like an enormous frog, but had powerful teeth and bony armor, and was near ten feet long. How he could jump! The

Eastman Kodak Co.

FIG. 19. WATERMOLS AS ICE DECORATION.

FIG. 20. WATERMOLS ESCAPING FROM A GLACIER.

curious Cycad trees had some assistance from me in their life and growth.

For one or two hundred thousand years I was imprisoned in an Antarctic glacier. Once I fell in a storm on the east slope of the Andes mountains, and was swept down into the headwaters of the Amazon river, and helped to make that big river all the way to the sea. That landed, or oceaned, me under the Equator. There the warm and still air held me for a long time in the Zone of Calms. I just had to lie around in the Doldrums, sometimes in the surface waters of the warm sea, and sometimes in the air. I do not remember just how I got out of the Doldrums.

DESTROYING THE CONTINENTS

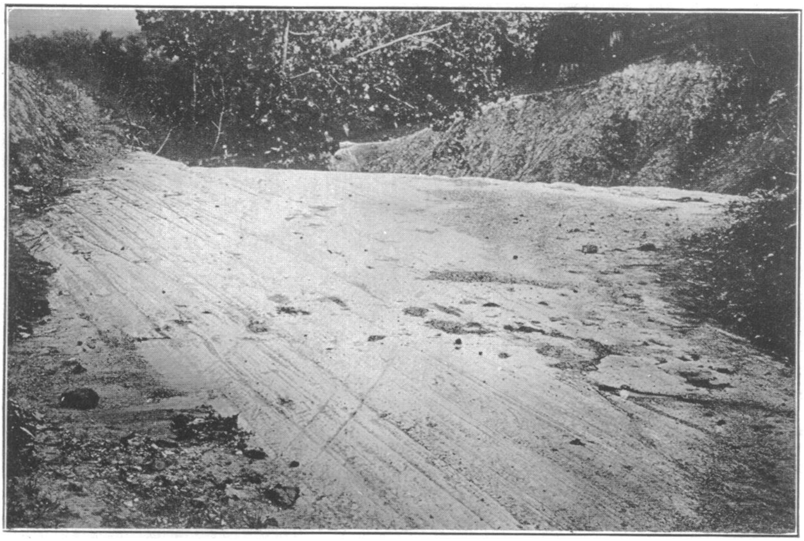
Let me interrupt the story to say that we watermols are chiefly responsible for changes in the land surfaces of the globe, and incidentally for making most of the fine scenery. Of course many of the best scenic features are credited to the Devil, but we are the real little devils that tear down the land. We do not like to see dry land standing up in the air. We think it should all be in our possession, nicely spread out on the bottom of the sea.

So we are always busily and persistently at work cutting away the continents and islands and carrying the detritus to the sea. Eventually everything on the surface of the land finds its way into the ocean, and we are the transporting agency.

If the continents will only stand still a little time we will get them. We would have destroyed them long ago but for the interference with our work by the interior forces of the earth—heat and gravitation. They deepen the ocean basin and crumple and raise the lands so that we have to do much of our work over again. At different times we have had most of the continental surfaces below our level and in our possession, but those terrible powers have lifted the sea bottoms into the air and we watermols have to pull them down over and over. But we are patient and tireless and keep right on at our task. When you stand at the ocean shore you see us always restless and sometimes fiercely tearing the shore. We have been doing this destructive work on the lands and constructive in the sea ever since the infant globe acquired an ocean, when it was somewhat larger than the moon, and we shall keep tirelessly at it as long as any land exists to challenge us.

We have many ways of attacking the land. As bees and ants have division of labor, so we watermols have our varied work; but we can change, and any of us can do any kind of watermol duty. Sometimes we simply dissolve the rock, such as limestone, salt or gypsum. As we made those rocks it is quite easy for us to reclaim them. Sometimes we merely dissolve the cementing material and cause the rock to fall to pieces. Then we wash the loose stuff down the slopes until our fellows of the creeks and rivers can grasp it. Our rivers make the canyons and the valleys. We are the valley-makers. Cascades and cataracts mark the spots where we find a little hindrance or delay in carving the valley. They do not last long. And the lakes are short lived, for the watermols there are too inactive; so we either drain the lakes by deepening the outlets or fill the basins with detritus.

When the air temperature is too low for us to exist and work as



S. Calvin, photo.

FIG. 21. TRACK OF A GLACIER.

fluid water we do not wait for a warmer spell, but get busy as frost and snow and ice. In high mountains and polar regions this is our favorite manner of working. The mountains do not last long. Nothing can stop our work of destruction or even discourage us. Here and there we may be hindered a trifle, but the mountains of to-day are big only because they are new, and in time they will be carried to the sea as we carried those of ancient time.

When we get the rock stuff fully in our possession we spread it out in beds—the fine stuff, like clay, in delicate horizontal layers and the coarser, as sand, in thicker sheets. In this way we have made the geologic record for many millions of years. In graceful wave lines and elegant ripples we have written our play time along the ancient shores; while in the even-bedded strata of clay or sand or lime, filled with the remains of the ancient animal and plant life of the sea, we have inscribed the wonderful record of the deeper or more quiet waters.

I have helped to make some of

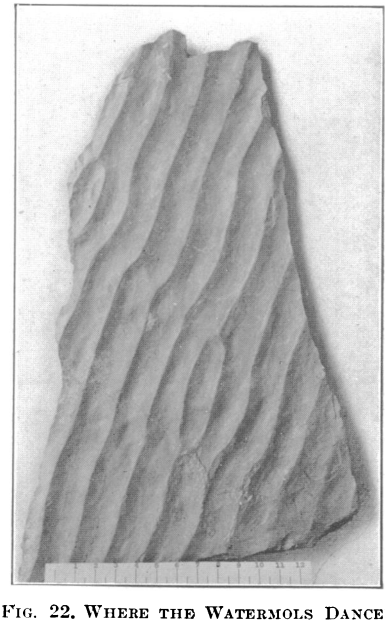


FIG. 22. WHERE THE WATERMOLS DANCED.

your famous scenic features, like Yosemite and the Colorado canyon, and have helped a little in pulling down the Alps and Sierras. I have been in many big and little waterfalls and lakes and streams innumerable. The next time that you stand before Niagara or by the Mer de Glace, or admire the quiet stream or the frostwork, look out for me. If I am not there it is because I have another job.

We watermols will all be working after you humans are gone from the earth, just as we were a hundred million years before you came. Perhaps if you would go back to breathing by gills so that you could live again in the sea you might survive longer. The ocean is the great reservoir of life, which may there persist after we have conquered the continents.

Why do we work so tirelessly? And do we work for the love of it? Well! motion, energy, activity is our nature; and we are restless for the same reason that the bird sings or the bee labors. Do you humans rush about like mad and strive and rob and kill each other just for fun, or because you can not help it?

(To be continued)